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CONTRIBUTIONS TO

WESTERN BOTANY.

No. IX.

BY

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August, 1900.

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MARCUS E. JONES.

PEUCEPHYLLUM SCHOTTII Gray has a synonym in *Inyonia dysodioides* Jones. The writer worked out the proper place of this genus in the *Compositæ*, and after being unable to match it by any material or published species or genus he sent it east for comparison for fear that it might prove to be some obscure genus not known to him. Receiving a reply that it could not be matched there he then ventured to publish it. Mrs. Brandegee, after receiving a specimen of it, informed the writer that it matched some material of her's referred to *Peucephyllum*. A second comparison at Harvard proved that it was identical with *Peucephyllum Schottii*. Dr. Gray having wrongly referred the genus to the *Senecionideæ* instead of the *Tagetineæ*, it was not found on the first comparison.

CHÆNACTIS MACRANTHA Eaton. The writer had long noticed that almost all specimens of the species in herbaria had a wilted or collapsed look, and also that growing it never seemed to be in good condition. On a recent trip into the desert the writer studied the plant growing and found it to be a night bloomer, the flowers collapsing early in the morning. A little after sundown the flowers open wide and the outer ones bend over and spread out, forming a large head of pearl-white flowers, as the pink outer part becomes invisible then. *C. stevioides* seems to be a trifle stiffer in the evening, but there is scarcely a perceptible difference in the flowers by day or night. All other species of *Chænactis* that the writer knows are day bloomers, or rather, keep open all the time.

GILIA PUNGENS and all its varieties, *G. Californica*, and *G. Watsoni* are all night bloomers, nearly all the other species of *Gilia*

are open all the time after they first come out. The night bloomers are all fragrant so far as I remember.

LYCIUM ANDERSONI Gray. This is a shrub characteristic of the desert region in the juniper belt of the Great Basin. It has the usual scraggly, stunted, tangled, and spiny look, forming a rounded mass about 2½ feet high and is rigid and with fleshy leaves, reminding one of *Sarcobatus* though denser and less high. It looks like a plant that would revel in alkali, but on the contrary it never grows in alkaline soil, nor do its leaves taste salty as those of such plants do. It prefers gravelly washes but occasionally grows on plains in the desert. The stems are tufted and bent, roughened throughout with many minute cracks which expose the thin layers of bark. The bark does not peel up into flakes but shows many thin edges and splits into flat threads. The older bark is spotted with many black specks. The twigs taper into needle tips and are white and knotty in the axils of the leaves, and come out nearly at right angles to the stems. The stems are often twisted and much bent. The wood is greenish and compact but rather brittle. The fruit is generally scarce, but this season occasional bushes were found which were loaded with the cherry-red berries, the larger ones being ⅓ inch long, round or slightly ellipsoidal, slightly acid, rather insipid, about as solid as a ripe huckleberry.

ASTRAGALUS KENTROPHYTA Gray var. **rotundus** This is the same as *A. tegetarius* var. *rotundus* Jones, Cont. VII, 650. The writer has for a long time tried to believe that *A. tegetarius* was distinct from *A. Kentrophyta*, but it is impossible to keep it up as anything but a sub-species at most. It is one of the very rare cases where a species that has its home in theoak or even in the juniper belt has a variety that inhabits the spruce belt almost to timber line.

Astragalus Craigi. Coll. by Howell on John Day's River, Or., May, 1885.

Habit of *A. drepanolobus* and *diurnus* Perennial, widely spreading, a foot long, nodes about 1 inch apart, slender stems and peduncles sulcate; petiole from ½ to ⅓ the leaf; middle leaves the largest, 3 inches long, of 4–5 pairs of obovate, long-

petiolulate, sub-alternate, emarginate, thickish, 3–4 lines long leaflets: whole plant nearly glabrous; pubescence fixed by the base, of short, appressed hairs; peduncles axillary throughout, ½–1 inch long with rachis the same, racemosely 6–8 flowered; bracts minute, triangular; pedicels slender, 1 line long; flowers white, 3 lines long, arched, reflexed; calyx tube campanulate, 1 line long, not oblique, narrowed below, teeth triangular, a little shorter and not arched; banner purple-veined, 2 lines long, oval, abruptly arched to 90° at calyx tips, sides reflexed, ½ line wide; wings oblong, ascending, 1 line longer than keel; keel a little exceeding the calyx teeth, rounded, obtuse, short, incurved, tip erect and straight; pods arcuate, oblanceolate, triangular-acute, when young laterally compressed, when mature inflated and cross section oval-reniform, sulcate dorsally and septum a little intruded, not nearly reaching the ventral suture, 3–3½ lines high and wide, sessile, nearly glabrous, papery, horizontal, with the calyx vental reflexed, not sulcate ventrally, nor ventral suture raised; stipules triangular, adnate, not connate, small, green. Distributed as *A. drepanolobus*. This has the habit of *A. drepanolobus* and the inflated pod of *A. Geyeri*. Dedicated to Prof. Craig, in whose herbarium it was found.

Astragalus Cusickii Gray. This interesting species was first discovered many years ago by Mr. Cleburne, a part of his original material being in my herbarium, but it was only a few years ago that it came into my possession. Cleburne's specimens were gathered at the entrance of the great Snake river cañon, just opposite Huntington, Oregon, in Idaho. Cusick's specimens were gathered also in Idaho and in the same cañon, but further north, near the town of Ruthberg. Last year the writer found the species growing abundantly at the type locality, and also at Goff, Idaho, near the mouth of the Little Salmon river. This season I also found it in full flower and fruit at Cleburne's locality, and had a chance to study it growing. It always grows on steep and gravelly hillsides in the *Purshia* (oak) belt. It has the habit of *A. filipes* Gray and the flowers are scarcely distinguishable from that species, but the ballon-shaped pods show that it is closely related to *A. Hookerianus*.

It grows in close tufts 2½ feet high and is erect, like *filipes*. When young the flowers are almost pure white, turning to cream-color with age, ¾ inch long, horizontal; calyx 1½ lines long, almost round in cross-section, nearly truncate at base, inserted a trifle below the middle, white, both sides straight, mouth gibbous, the lower side decidedly longer; teeth ¼ line long, deltoid-triangular; banner fiddle-shaped by being much contracted ⅓ the way up from the base, abruptly arched to vertical at a point 1½ to 2 lines beyond the calyx tips, a little hooded at tip and with a somewhat thickened claw, nearly oval in outline but appearing oblong, sides reflexed only in the middle, but much so there, and with the reflexed part about a line wide, sulcus very deep and a mere slit at base, but it shallows and becomes very broadly V-shaped above, water-lined, erect part 3 lines long, truncate at tip, wings about 2 lines wide and one line longer than the keel; obliquely oblong and rounded, both of them concave to keel and flaring beyond it, nearly straight; keel blade about 2 lines long, abruptly rounded and with straight and erect tip, 1½ lines high, acute, yellow-tipped; pods horizontal, cross-section half-oval, broadly shallow-sulcate ventrally, compressed at the short-stipitate base, very thin and papery, with oily or watery drops inside, translucent, red-nerved and stippled above, nearly straight. Fruit ripe in May.

ASTRAGALUS MULFORDÆ Jones. This was described provisionally from a single specimen collected by Miss Mulford at Weiser, Idaho, there being no data to indicate its habitat. Last year the writer found it almost out of fruit, and this spring again in full flower and fruit. Unlike the species to which it seemed the most related its habitat is on the hottest south slopes of yielding sand beds on the upper edge of the juniper belt. Back of Weiser there are bluffs several hundred feet high of friable clays, sands and infusorial earth, which weather into steep slopes with soil so soft that a person's feet sink down several inches as he walks or climbs over it. This is the home of this species. The roots are single, thick and fleshy at the erect tip, and run down many feet nearly straight into the ground; at the crown they branch into many smaller crowns which form an open mat a few inches wide, from the mats

arise the slender decumbent stems much after the fashion of *A. Nuttallianus*, but more erect, only the outer stems being prostrate. The flowers are like those of *A. Nuttallianus* and are about 3 lines long; banner 2 lines wide and 2½ lines long above the bend, dirty-white and water-lined, abruptly bent to over 90° ½ a line beyond the calyx tips, deeply and broadly sulcate to the tip with a sulcus ½ a line deep and a line wide which occupies all of the upper half of the banner, sides reflexed about ¼ a line wide opposite the end of the keel but not at all at tip, banner nearly square, emarginate, with just the faintest trace of a white spot in the center; wings obliquely-elliptical, nearly a line wide in the middle, the right-hand one being folded past the end of the keel and the left-hand one flaring much, but both touching each other at the tip, both concave to the keel and obscurely notched below the tip, fully a line longer than keel and arcuate upwards, white, not distinctly water-lined; keel very short, abruptly bent at the end into nearly ½ a circle, slightly darker at tip, very blunt; calyx campanulate, a line long, with subulate teeth ½ a line long in addition, straight, a little obliquely inserted at the acutish base; pedicels slender, ½ a line long, as long as the ovate bract; fruit with ventral suture in some cases, distinctly concave, though normally convex, 2-celled by the intrusion of the dorsal suture which is a line wide exclusive of the shallow sulcus, papery pod smooth or minutely hairy, hoary when young, pendent, acute at both ends, triquetrous and with concave sides; stipe 1½ lines long; stipules large, green normally, 2 lines long, triangular, adnate, not connate, the lower ones often hyaline and imbricated; stems a little angled, not sulcate. This was in flower and fruit April 19, 1900, but keeps blooming for some weeks.

ASTRAGALUS GLAREOSUS Dougl. The writer spent some time in the home of this species, but did not remain long enough to complete his studies on this and the allied forms; sufficient information was gained to nearly satisfy him that this and *A. inflexus* are identical except that the latter is more caulescent.

ASTRAGALUS MALACUS Gray. This species as it generally occurs is remarkably well characterized, only in its southern range

does it seem to vary much. It was found on April 27, 1900, near Weiser, Idaho, considerably out of its usual range. Specimens gathered there show flowers ¾ inch long, pink-purple; wings and keel same color; wings nearly straight, broadly linear, a little narrower toward the tip, a line wide, narrower than the keel and a line longer; banner ovate, sides reflexed to the sulcus throughout, the reflexed part fully 1½ lines wide at base of banner; sulcus V-shaped below and more shallow above; keel rounded in an arc of a circle and very obtuse, blade 7 lines long and claw not exserted; white spot on banner large and purple-veined, oblong; calyx thin, much compressed, lower side straight, upper side arched, inserted in line with the base; teeth linear-subulate, calyx 5-nerved, pink; young pods white-hairy.

ASTRAGALUS PURSHII Douglas var. TINCTUS Jones has the flowers almost exactly those of *A. Utahensis* in color (a brilliant pink-purple); banner broadly elliptical; gently arched to 45° from the end of calyx tube; sulcus narrowly U-shaped for 4 lines in length, then widens to about ½ a line near the tip, and at the tip it vanishes, it is very narrow at the base of blade; white spot spatulate, a line wide at tip, comes within a line of the end of the blade; sides of banner reflexed for 2 lines in width in the middle on each side, all but the sulcus being reflexed; banner barely notched; wings broadly linear, concave to keel, narrowed at tip, almost straight, 1½ lines wide at base, rounded at tip and obtuse, narrower than keel and exposing both its upper and lower sides; keel gently arched to 90° from the base, dark-purple-tipped, very obtuse, straight, blade barely 3 lines long; calyx inflated (as is the case with the type and with *A. Utahensis* also), much compressed laterally, red-lined, constricted at tip, 6 lines long, subulate teeth 2 lines more, both upper and lower sides of calyx a little arched, a little fleshy and narrowed at the base; pods abruptly incurved at tip in the Idaho forms.

ASTRAGALUS ARTEMISIARUM Jones. It seems like a very slim foundation to build a species on the color of the flowers and the presence or absence of pulp in the pod, which are the characters which separate this from *A. Beckwithii*, but diligent search this

season fails to show any intergrades. The pods are more mottled, much more rigid, the whole plant less leafy, leaflets smaller, and the whole inclined to be glaucous.

ASTRAGALUS BECKWITHII Torr. Watson, in his revision in King's Report, never seems to have suspected the genetic relationship of this plant, as he placed it with the "Argophylli," with whose species it has not the slightest relationship. Its true place is with the "Inflati" and it is a very close congener to *A. oophorus*.

ASTRAGALUS BECKWITHII Torr. var. **Weiserensis.** Leaflets about an inch long, ovate to oval-ovate, contiguous, glaucous, very obtuse, 4 to 5 pairs, thick; stems, peduncles and petioles very sulcate and stout; pods little mottled, coriaceous, slightly corrugated, distinctly transversely veined below, much obcompressed, about 2 lines high, 4 lines wide and an inch long, arcuate to ⅓ circle, pungently acute, oblong-elliptical in outline, ventral suture raised ½ a line high as a thin and papery keel; flowers few, shortly racemose or almost capitate, about an inch long, nearly white; banner abruptly bent to 80° at a point a line beyond the calyx tips, cream-colored, broadly oblong, somewhat fiddle-shaped, being contracted ⅓ the distance above the base, sides reflexed only near the middle, water-lined, with no white spot, the base of the blade sticks down like ears on each side below the keel-tip, base very thick and rigid and fleshy, swelled and larger at keel-tip and tapering from there to the end of the claw; sulcus conical and much constricted below, disappears at tip of banner in a groove; wings broadly linear or elliptical-oblanceolate, over a line wide, deeper cream-colored and water-lined throughout, tip rounded but almost acute, entire, arched a little, flat to keel and flaring a little at tip, not as wide as, but two lines longer than the keel; keel straight, tip straight, erect, blunt, yellow, the blade 3 lines long; calyx decidedly compressed, oblique, hyaline, truncate at base and oblique there, lower side straight, upper side arched, smooth, teeth subulate, 2 to 2½ lines long, tube as long; bracts subulate-lanceolate, 6 lines long, green; pedicels ½ to a line long, stout; flowers horizontal; stems rather short, rarely over 6 to 10 inches long and decumbent. Taken as a whole this

is a much more robust and coarser plant with more inflated pods. It grows at Weiser, Idaho, on mesas and is common.

STANLEYA CONFERTIFLORA (Rob.) Howell. Mr. Howell, who goes the Brittonians one better in erecting all varieties and forms into species without distinction, has accidentally made a fine species in this Stanleya. Though it is somewhat related to *S. viridiflora* it is a better species than *S. elata* Jones. The writer discovered it on April 27, 1900, near Weiser, Idaho, and later saw it in several places and had a chance to study it in all its phases. It, like all the other species, prefers rather loose clay soil where little else will grow, and grows only in the juniper belt. It is biennial, with a single stem from a stout, single, straight and erect root; the stems never branch except when injured, though the crown occasionally produces more than one stem; about half of the plant is the wand-like and very showy and long spike of flowers, yellow as gold; stems round, neither angled nor winged; leaves entire and like those of *Arabis perfoliata;* pedicels an inch long, ascending, rather stout, enlarged at both ends; sepals light green, linear, ¾ line wide, obtuse, flat, faintly nerved, becoming reddish-yellow with age, very inconspicuous, erect, spreading only when old and then often twisted, thin but thickened at very base; petals very delicate and crimped, thin, ¾ line wide, fully 6 lines long, gradually reduced to a flat but nearly filiform claw 8 lines long, which is thickened at base; petals greenish-yellow, turning to white as they dry, white by the time the anthers begin to open, fully out before the sepals open except at the very tip, the anthers also being still inclosed in the sepals; anthers 2-celled, 3 lines long, broadly linear, obtuse, straight, as the cells begin to open at the tip they coil tightly as they open, they are attached by the end; filaments are like the claws of the petals but not flat, filiform, about 9 to 12 lines long when fully out, all the floral parts perfectly smooth; immature pod 4 inches long, linear, on a stripe a trifle stouter than the filaments and as long, pod minutely and abruptly and bluntly apiculate; spikes dense, 1 to 2 feet long; whole plant is usually about 3 feet high.

VIOLA BECKWITHII T. & G. This plant is locally abundant at Weiser, Idaho. It has a little different habit from the species

growing in Utah, but the same peculiar pubescence, the early flowers come out before the leaves, and it grows in practically the same situations, dry mesas. The 2 side petals have an oblong area at base, opposite or a little above the end of the stigma, which is covered with yellow, club-shaped hairs, there are none on the other petals; the lower two petals purple-veined below and tips of veins brush-like; stamens 5, with filaments about a line long and ¾ of a line wide, flat, thick, 3 of them without a keel and purple-tinged in the middle, the 2 lower ones with a very broad and flat keel, ½ as high as long, flat on the edge and thick, all have a nearly square to ovate-oval, wing-like and very thin tip a line long, brick-colored, rounded, concave to stigma; anther cells attached to the inside of filament the whole length, 2, opening the whole length but after the stigma has protruded; style club-shaped, a little bent at the tip of the ovate pod, 1½ lines long; stigma fornicate, covered with flat hairs. The white petals have a yellow base, the purple petals a greenish base. This was in full bloom April 20th, 1900.

LINUM KINGII Watson. Petals rotate spreading, obovate or oval, lacerate or uneven on the edge, faintly veined, yellow; claw very short, a line wide; styles 5, widely spreading, filiform, yellow, 3 lines long; anthers oblong-ovate, acutish, sagittate, erect, stamens erect so that they stand above the spreading styles; stigmas very small; filaments a line shorter than the styles; capsule ovate or oval. The edges of the sepals are lacerate-toothed. This is taken from the plant while growing, and from the type locality of Watson.

LINUM LEWISII Pursh. This grows in the oak belt and never is found in the upper spruce belt, where the other species mentioned grows. It grows on dry and gravelly soil and singly, like the annual species. It is very slightly woody at base but never a true shrub like *L. Kingii.* Flowers ¾ inch wide, rotate, but with a short, campanulate base a line high, considerably lighter than sky-blue and with a tinge of purple, petals rhombic-obovate, nearly truncate, slightly lacerate, without claw, many-veined, veins at base of petal 5, very dark blue-purple and prominent, quickly branching, like a fan, and these again splitting and be-

coming fainter, till they are barely visibte at the tip of the petal, no interlacing veins anywhere; for about a line above the base and about a line wide there is a dark-blue ring around the corolla (beginning where the veins first branch), below this to the base the petals are golden yellow and so a yellow eye is formed in the center of the flower; filaments linear-subulate, blue on the upper ½; stamens with versatile anthers ½ a line long; styles 5, from double to ⅓ longer than the stamens, filiform, barely globularly enlarged at tip; ovary nearly globose; 3 inner sepals wider and obtuse, hyaline, 2 outer ones ovate and acute, green, not nerved; buds pendent; flowers erect; petals convolute in the bud, with blue veins on the outside and yellow-hairy at the base within; leaves and sepals coriaceous and glaucous; the stems are tufted from the crown but unbranched. This species is quite common throughout the Great Basin.

The Great Salt Lake Desert.

The writer was much interested in crossing the Great Desert west of Salt Lake City, which, on the maps, is called the Great American Desert, to see Nature's provision for redeeming the barren waste. This desert is supposed to cover all of the region west of the shores of Great Salt Lake, from near Kelton, southward to the north end of the Fish Springs range (the first range east of the Deep Creek mountains, or Mt. Ibapah) and westward as far as the Toano range, which is the first range west and north of the Deep Creek mountains. All this region, and more, was once the bed of Great Salt Lake and probably was covered with water less than 5,000 years ago. It is almost level and averages 4,400 feet above the sea. But the area that is actually without vegetation is only a small part of this region. It begins at a point almost due east of Mt. Ibapah and runs northward for, say 30 miles, and is about 20 miles wide. Then the western side runs almost due north toward Pilot Peak for another 20 miles and then swings eastward. The eastern side of the area turns northeastward about opposite the north end of the Granite range and extends nearly 100 miles toward Great Salt Lake. The whole barren area lies between the Granite range and the Deep

Creek mountains, till it passes beyond the northern end of the Granite range, after that it occupies the center of the flat area south of Pilot Peak and east of Dutch Mountain (which is the northern extension of the Deep Creek mountains) there is probably no part of it that is over 40 miles wide. This barren area has no pebbles, gravel, or sand, it is wholly a compact yellow clay, like putty, carrying a small percentage of soluble salts, probably not exceeding 10 per cent. in any case. These salts are mixed in about the following proportions: chloride of sodium, 8 per cent.; chloride of magnesium, 1 per cent.; sulphate of sodium, .7 per cent.; sulphate of potassium, .3 per cent.; sulphate of calcium, .09 per cent. In addition to the above there is a variable amount of carbonate of sodium which will raise the total percentage of soluble salts somewhat, but this latter is never great in the barren area, it seems to be confined mostly to the surface, though there are places outside of this part of the desert where the carbonate of sodium is in excess of the chloride of sodium and is evidently caused by the decomposition of the Palæozoic limestones and adjacent rocks. There are places in this desert where, by a process of natural (in distinction from articificial) precipitation, the more soluble salts have been deposited separately from the chloride of sodium, and in separate places. In such cases, when the soil contains only common salt (chloride of sodium) on drying it becomes perfectly solid, smooth and without a crust, but dries very slowly, and is unaffected by the agencies mentioned below, but when the soluble elements are complex, as is the case in the barren area, then, on drying, there is a white crust formed of concentrated salts which is raised ½ to an inch above the moist soil below and is mixed with more or less yellow clay which it has taken up on parting from the soil below. Sometimes this crust is mostly salts, and generally it is at least ⅔ soil, and light and fluffy but glistening with salts. This crust the high winds, which prevail over the desert, take up and carry far away in clouds. If a rain should follow one of these storms of wind, then the soil and salts are washed out of the air and we have, what seems to be peculiar to Salt Lake City, salt showers. These are rare in the city, but

remarkable when they do occur. By this, the only possible agency the great alkaline deserts are being gradually made less salty and alkaline, the barren area more contracted, and an incipient water channel is forming which, in winter, at least, will drain off the salts of the desert into Great Salt Lake. By this means we see the barren area being deepened as well as contracted, and at the same time the surrounding area increased and raised. This raising is greatly assisted by the character of the vegetation and its peculiar mode of growth. It should be noted that the constant blowing off of the concentrated salts of the surface would, in time, take away most of the alkaline elements of the soil, till the alkalinity were reduced to at least 3 per cent., or may be less, even though much of it gets back again by being washed out of the higher adjoining ground. The whole tendency of the wind and drainage is to dump all the saline elements into Great Salt Lake, and it is a noteworthy fact that the wind is doing what the water cannot do in this regard. Another agency for sweetening the desert lies in the leaves and stems of the alkali-loving plants. They are conspicuously salty and thus lift above the soil the saline elements, when they die each carries a small portion of alkali locked up in it, and when the wind carries the dead leaf or twig away it also takes the salt.

The pioneer plant in the redemption of the desert is *Spirostachys occidentalis* Watson. *Salicornia herbacea L.* also grows in soil as salty, but its value is infinitessimal because of its mode of growth and its annual habit. We find Spirostachys encroaching on the desert on all sides. It extends miles further out than any other plant. The seeds, on germinating, form thick and bent roots which are tangled and increase much faster than the stems which arise from them. As they grow they lift up the soil in larger and larger masses. A plant only six inches high generally makes a mound half as high and several inches wide. This is increased both in height and extent as the plants grow till the mound sometimes reaches 10 feet high, but usually they reach 2 feet, and are about double to triple this extent horizontally. The winds of the desert, instead of blowing off the soil from the roots, and so reducing their height, deposit their dust among the roots

and stems and make the mounds larger. The winter's rains and melting snow percolate through the mass and leach out the alkaline elements till very soon we find the mounds occupied by *Sarcobatus*, *Kochia*, and at length *Atriplex confertifolia* and species of *Tetradymia*, the *Spirostachys* having long ago died. Among annuals we also find *Streptanthus longirostris* as one of the first occupants of Spirostachys mounds. The further away we get from the barren area the larger the Spirostachys mounds become till we are five to ten miles off. Then the mounds are so thick and so many that it is difficult to drive through them. After that the Spirostachys is seldom seen, it having died out and been replaced by the species mentioned. From this point also the mounds decrease in size, as the new occupants of the mounds are not able to resist the wearing action of the wind. At length, we have a plain thickly covered with the usual desert shrubs and only slight elevations around them. This is the process which Nature is now using to redeem the Great Salt Lake Desert, and it has completed about nine-tenths of its task.